Status of the Claims

This listing of claims is identical to the originally filed claims.

1. (Original) A charge pump, comprising:

an input/output (i/o) circuit that generates a voltage control signal and an input voltage signal from a voltage difference signal; and

a transconductance amplifier having first and second circuits that receive the input voltage signal and that produce first and second current signals, respectively, the transconductance amplifier being used to provide a current output to the i/o circuit based on at least one of the first and second current signals, the current output being used to provide charge for the voltage control signal,

wherein the voltage control signal and the input voltage signal are generated from the voltage difference signal,

wherein the first current signal makes up more than half of the current output when the input voltage signal is within a first range of voltages,

wherein the second current signal makes up more than half of the current output when the input voltage signal is outside the first range of voltages,

wherein the second current signal is included in the current output when the input voltage is in the first range of voltages and outside the first range of voltages.

2. (Original) A method, comprising:

(a) receiving a voltage difference signal at an i/o circuit of a charge pump;

(b) generating a voltage control signal and an input voltage signal in the i/o circuit using the voltage difference signal; and

(c) generating a current output signal in a transconductance amplifier, which is coupled to the i/o circuit, using the input voltage signal, the current output signal providing charge for the voltage control signal;

(i) generating more than half of the current output using a first portion of the transconductance amplifier when the input voltage signal is within a first range of voltages;

(ii) generating more than half of the current output using a second portion of the transconductance amplifier when the input voltage signal is outside the first range of voltages; and

(iii) generating a portion of the current output using the second portion of the transconductance amplifier regardless of whether the input voltage signal is within or outside of the first range of voltages.

3. (Original) A phase-locked loop (PLL), comprising:

a phase detector that receives a reference clock signal and a voltage controlled oscillator (VCO) output signal, which generates a voltage difference signal therefrom;

a charge pump that receives the voltage difference signal and generates a voltage control signal therefrom, the charge pump including a first circuit and a second circuit; and

a VCO that receives the voltage control signal and that generates the VCO output signal therefrom,

wherein the first circuit generates more than half of the charge when the VCO output signal is within a first range of voltages,

wherein the second circuit generates more than half of the charge when the VCO output signal is outside the first range of voltages,

wherein the second circuit generates a portion of the charge when the VCO output signal is within the first range of voltages and outside of the first range of voltages.

4. (Original) The PLL of claim 3, wherein:

the voltage difference signal includes one or more up signals and one or more down signals;

the up signals are asserted when the VCO output signal lags in phase or has a higher frequency than the reference clock signal; and

the down signals are asserted when the VCO output signal leads in phase or has a lower frequency than the reference clock signal.

5. (Original) The PLL of claim 4, wherein at least one of the up signals and the down signals comprise a differential pair of signals.

6. (Original) A method of phase locking a VCO output signal to a reference clock signal using a PLL comprising a phase detector, a charge pump having a transconductance amplifier including first and second portions, and a VCO, the method comprising:

receiving the reference clock signal and a VCO output signal in the phase detector;

generating one or more voltage difference signals using the reference clock signal and the VCO output signal;

using the one or more voltage difference signals to generate a voltage control signal in the charge pump, the voltage control signal having sufficient charge for VCO operation; and

generating the VCO output signal in the VCO using the voltage control signal,

wherein the first portion of the transconductance amplifier generates more than half of the charge when the VCO output signal is within a first range of voltages;

wherein the second portion of the transconductance amplifier generates more than half of the charge when the VCO output signal is outside of the first range of voltages,

wherein the second portion of the transconductance amplifier generates a portion of the charge regardless of whether the VCO output signal is within or outside of the first range of voltages.

7. (Original) The method of claim 6, further comprising including one or more up signals and one or more down signal in the voltage difference signals comprise one or more up signals and one or more down signals, wherein:

the up signals are asserted when the VCO output signal lags in phase or has a higher frequency than the reference clock signal; and

the down signals are asserted when the VCO output signal leads in phase or has a lower frequency than the reference clock signal.

8. (Original) The method of claim 7, further comprising including a differential pair of signals as at least one of the up signals and the down signals.